

Oct 95

## GRANT AND LINCOLN IN BRONZE.

THE NEW EQUESTRIAN STATUES BY O'DONOVAN AND EAKINS—HOW HORSE AND RIDER WERE FASHIONED IN CLAY FROM LIVING MODELS—HOW THE CASTS IN PLASTER AND BRONZE WERE MADE.

BY CLEVELAND MOFFETT.

With pictures, chiefly from photographs taken especially for this Magazine.



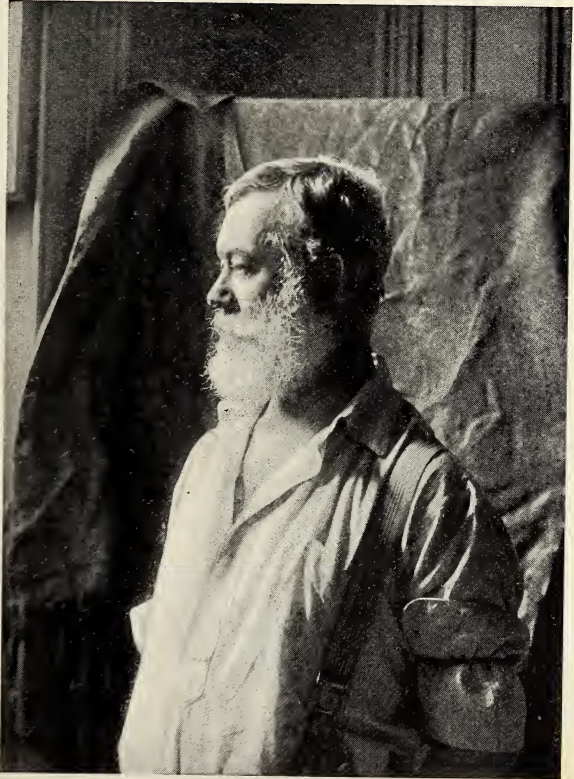
On the south side of East Twenty-fifth Street in New York City, just out of the roar of Third Avenue, stands a dingy brick building, on whose front big black letters announce "Fine Art Foundry."

There is little of art in this neighborhood, where pale-faced children play noisily on the sidewalks, and coal and beer wagons seldom cease their rumble. At the door the sound of hammers ringing on metal greets one.

A queer place, one would think, to find Ulysses S. Grant and Abraham Lincoln; yet here they are, or were during the summer months, eying the visitor with stern salutation from the backs of their bronze horses. A workman on his knees pounds with quick strokes at the foreleg of Lincoln's horse, which he is fitting on, this being the finishing touch, for the two statues are completed. Lincoln sits with head bared, holding a queer tall hat in one hand, as if saluting regiments of soldiers, cheering, doubtless, as they march past in review. His horse stands restive, champing his bit, with head turned out, eager to be off. General Grant, small of stature compared with Lincoln, looks neither to right nor left, but rides along in a characteristic business-like way, mounted on a splendid charger, the effect of movement in his horse being rendered wonderfully, not only by the lifted forefoot, but by the poise of body and the accurate filling out of every muscle.

These are the two life-size equestrian

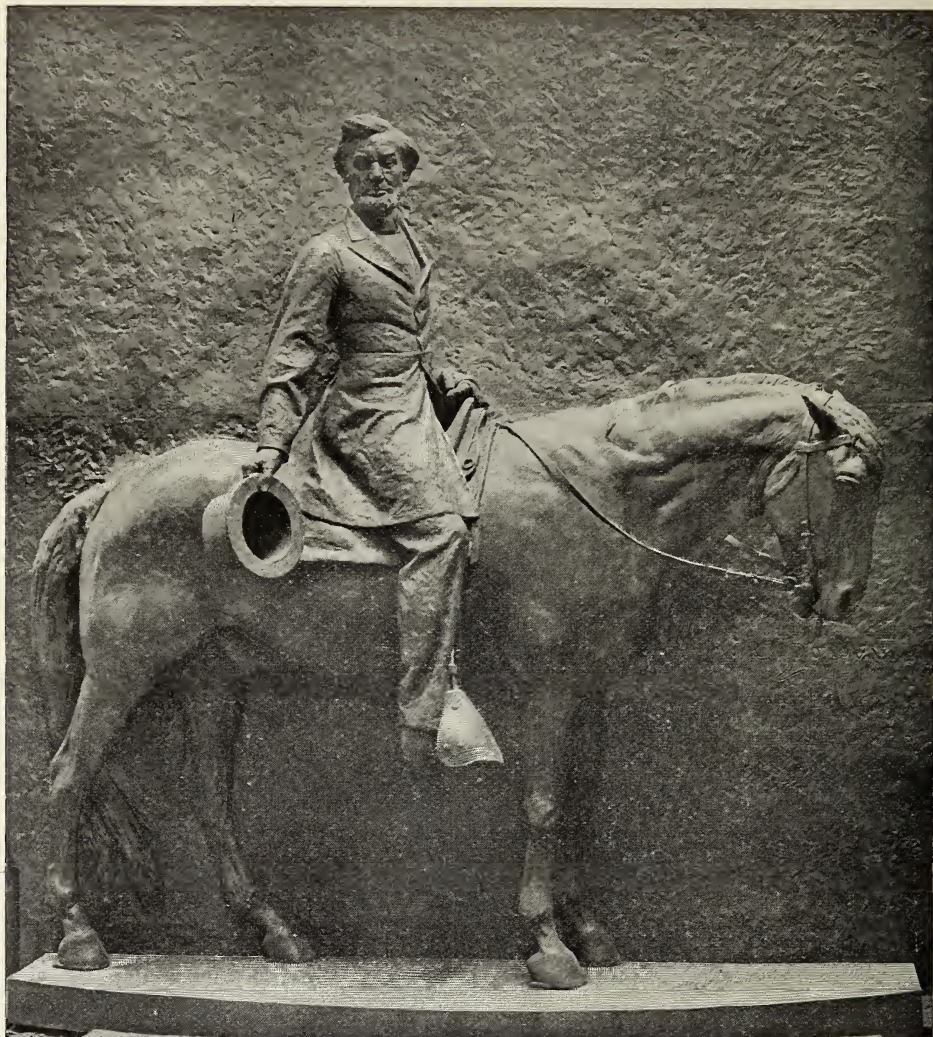
statues, bas-reliefs, that are to serve as panels in the Brooklyn memorial arch. It is four years since the State of New York, acting through the officials of Brooklyn and Mr. Duncan the architect, gave William R. O'Donovan and Thomas Eakins the com-



W. R. O'DONOVAN IN HIS STUDIO.

mission to model these works. And now that the result has been achieved after much labor, it is a pleasure as well as a source of instruction to turn back and see in some detail how the statues were made. For not small is the task of a sculptor





EQUESTRIAN STATUE OF LINCOLN, MADE BY O'DONOVAN AND EAKINS FOR THE BROOKLYN MEMORIAL ARCH.

charged with perpetuating, in visible form, the two great heroes of our history, so that generations and centuries to come may look upon their faces and behold them as they were in life. I do not think the story of the making of a bronze statue has ever been properly told.

Experts have said that American sculpture cannot boast a single good horse in bronze, except perhaps the one by H. K. Brown which cavorts in spirited though rather conventional fashion, under the weight of Washington, on the monument in Union Square, New York. Mr. O'Donovan determined that no such reproach should be made against his work; and although himself a practical horseman, being a Virginian

and an old soldier, he decided to associate with him some artist who possessed such expert knowledge of a horse's anatomy as would render impossible any error in the modelling. His ambition from the first was to show in these two statues real men on real horses.

Casting about him for an artist of such special talent as was needed, Mr. O'Donovan found the very man he wanted in his old friend Thomas Eakins, for many years at the head of the art school in the Pennsylvania Academy of Fine Arts, and lecturer on demonstrative anatomy at the National Academy of Design. While studying in Paris, Eakins had been one of Gérôme's favorite pupils, and even at that





EQUESTRIAN STATUE OF GRANT, MADE BY O'DONOVAN AND EAKINS FOR THE BROOKLYN MEMORIAL ARCH.

time his fondness for dissecting and anatomical studies had made him remarkable among the other students. Since establishing himself in Philadelphia he had gained wide reputation among the best surgeons as an anatomist, and for years it had been his habit to take his pupils regularly to the horse "heaven" for practical demonstrations. There is probably no man in the country, certainly no artist, who has studied the anatomy of the horse so profoundly as Eakins, or who possesses such intimate knowledge of its every joint and muscle. He was therefore called into collaboration with O'Donovan, and the statues as they stand to-day are the joint work of these two artists.

In modelling the horses the artists agreed to depart from the method, frequently adopted, of presenting a composite horse, patched together from fragments of many horses, taking the good points of each and avoiding the defects. They decided, rather, to choose an animal which should possess a union of fine qualities, and then make in clay as perfect an image of that horse as they could. Then came a search for two horses worthy of such high honor, and months were spent before the sculptors found the animals they wanted. The chief difficulty encountered was in finding a horse for Grant, since any strong mount would do for Lincoln, who never cared for a showy charger, and, indeed, during his Presidency



AN UNFINISHED STATUETTE OF THOMAS EAKINS, BY HIS PUPIL  
SAMUEL MURRAY.

was in the saddle only on special occasions. For the Lincoln statue they selected a powerful "cowboy" horse, named "Billy," that Eakins had brought from the West, an animal of great strength and endurance, but not of specially fine breed. "Billy" was felt to be in harmony with Lincoln's simple and unpretentious character; he was just such a horse as the President might have got from some trooper, or have ridden when he was a lawyer practising in circuits covering fifteen counties. A good horseman he was in those days, as one learns from Robert G. Ingersoll, who also rode and practised law in that section before either had gained fame. But to find a horse suitable for Grant was another matter; for here was needed a charger of ideal proportions, a creature of strength and race, a splendid animal fit to carry a great commander into battle. Nor could they choose at random; for, while there is no authentic record of the horses Lincoln rode, the names and descriptions of Grant's horses, with careful photographs, are preserved in history. Every soldier knows how the general loved his big "Cincinnati," whose fine points are still proudly spoken of by Colonel Fred Grant and others who remember him. Had "Cincinnati" been alive, the sculptors would have used him as their model; but "Cincinnati" was dead, and the little cob "Jeff Davis" was dead, and all the other horses ridden by the gen-

eral were dead. So the best they could do was to find some horse such as Grant himself might have chosen, and which would at the same time answer the requirements of the sculptor.

They visited West Point and saw many valuable and spirited saddle-horses, but they did not find what they were seeking. They gained, however, valuable suggestions for the action of horse and rider, and spent many days observing how our soldiers ride, for cadets are taught horsemanship to-day just as they were when General Grant learned the art. West-Pointers sit in the saddle almost as "cowboys" do, except that their stirrups are a little shorter, while the soles of the feet are kept level. The young men have to ride bare-back first; and to assist the sculptors, Captain Craig, the instructor of cavalry, and himself an ideal cavalry rider, slight of build, quick, and graceful, ordered out some of his best riders, who posed for the artists in every position a soldier would take on a horse; Mr. Eakins making dozens of instantaneous pictures showing the men as they held themselves in a trot, a gallop, a walk, or reining in their horses for a quick stop, or in leaping to the ground, or in subduing a vicious horse, as all cavalymen know how to do, by the trick of catching the foreleg quickly and throwing the animal. Other photographs were made at another place

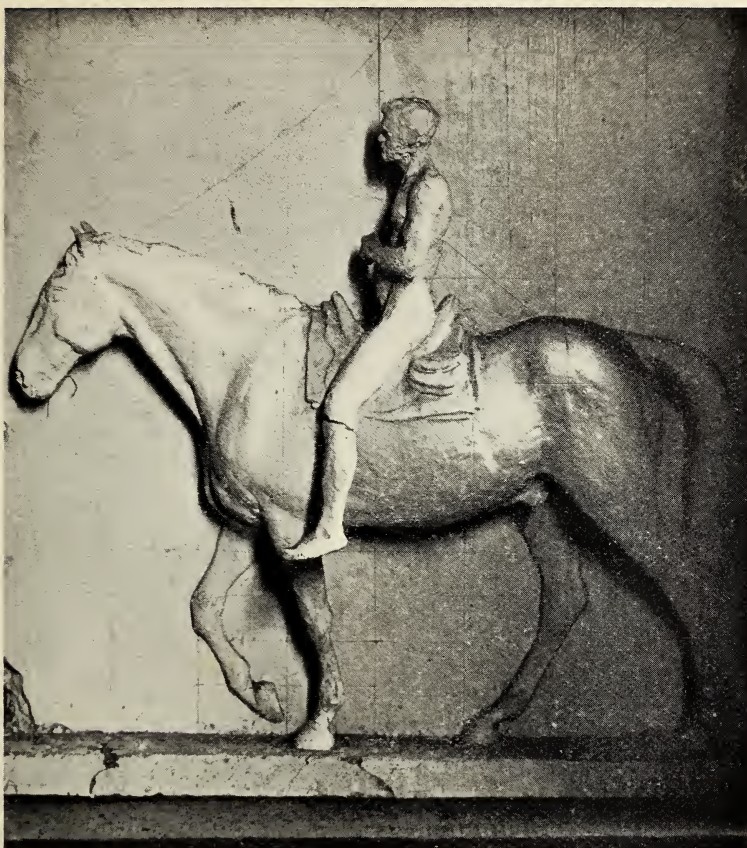


A NUDE POSE.

with the rider sitting nude on the horse's bare-back. And, not content with the photographs, the sculptors went even to the length of making many small studies in wax of various actions.

Continuing their search for a horse for General Grant, O'Donovan and Eakins vis-





FIRST STUDY FOR WORKING MODEL OF THE GRANT STATUE.

ited many places, saw prize horses at the horse show, fashionable horses at Newport and Long Branch, trick horses in circuses, and rejected them all in favor of "Clinker," a saddle-horse owned by A. J. Cassatt, of Philadelphia. In "Clinker" there is not a pound of waste matter, but everything seems to be made for speed and endurance. He is a short-coupled horse, with just room on his back for a saddle, as a charger should be, with great breadth of chest, and at once heavy and compact.

Thus the two artists spent months of serious effort before a single stroke in the clay had been made, or the first step taken in the actual work of sculpture. And before commencing the real work on the large statues they were obliged to make quarter-size models, and submit these to the Brooklyn committee for their final acceptance. All this having been done, the two horses were taken to a farm near Avondale, Pennsylvania, where Mr. Eakins's sister lived, and where the sculptors could be sure of

the desired seclusion for the important work of modelling from life.

First a wax model was made one-sixteenth the linear size of the finished statue. Then a quarter-size model was done in clay, and afterwards in plaster; and, finally, the life-size work was begun. Hour after hour, day after day, Mr. Eakins, mounted on an Indian pony, rode about a field studying whichever of the two horses he was modelling, "Clinker" or "Billy," ridden by a colored lad as the sculptor might direct. With the wax model in hand he studied every step and movement, making in the wax now and then some quick correction with a sweep of his thumb. The wax model thus perfected contained the germ of the finished statue. Next the quarter-size model in clay was finished, also in the field, and cast into permanent plaster form. This, when finished, was scratched with parallel lines running from side to side and from top to bottom, about three inches apart. These lines were for guidance in building up the

frame for the life-size statue, it being very simple, with their aid, by compasses and the like devices, to make a uniform enlargement four-fold.

The frame for the full statue was not made in one piece, but in ten, each being set up and finished separately; thus there was one section for each of the legs, one for the hind quarters, one each for the head and shoulders, and three for the body. Each was carefully constructed of wood, braced with iron rods against a background of boards, and covered with wire netting, the effect being as of a core of the part to be reproduced. Over this core the sculptor spread his clay an inch deep. These preliminaries accomplished, modelling began again from direct study of the live, moving horse. Every day Mr. Eakins would have the horse he was portraying led out beside the box on which his frames were placed, and he would copy in the clay every curve and muscle and vein of that part of the horse corresponding to the frame. As soon as each section was finished in the clay a cast of it was made in plaster, and when all the sections were done they were carefully fitted together into a whole.

It was in April, 1892, that the model of Mr. Cassatt's horse was finished in clay, and, having been reproduced in plaster, was sent on to New York for the final work of mounting him with his illustrious rider, which was to be done in Mr. O'Donovan's studio on East Seventeenth Street.

To assist in the work of composing true images, the sculptors obtained from the War Department prints of all the Brady negatives stored there of both Grant and Lincoln, not less than a hundred, and many of them very large. It is the first instance of copies of this unique collection issuing to any private person. Copies were given out at the time of General Grant's death in order to prepare some large albums for President Cleveland and the members of his cabinet.

The sculptors were also fortunate in obtaining death-masks of Grant and Lincoln.

Thus gathering material from many sources, they began modelling in clay the face and figure of General Grant, aiming to express as faithfully as might be his likeness and character at a period somewhat

prior to the ending of the war. During the later years of his life, under presidential honors and freedom from activity in the field, Grant's face lost that clean-cut quality, that alertness of the fighter, which it had formerly possessed. It gained in gravity and dignity perhaps, but lost an indefinable something that had made his features during the war most interesting.

The general idea at which the artists aimed was to show Grant riding leisurely along, as if at the head of an army during a long day's march. In placing the figure in the saddle they made use not only of the other photographs taken at West Point, but also of photographs made there of Jesse Grant, who is the same weight and size as was his father at the close of the war.

But they also studied a living model, sitting actually in the saddle, a man of about forty-six, of soldierly build, who, being the son of a Philadelphia painter, possessed himself some sense of art. The same man served also as a model for the Lincoln statue. Most of this study was for anatomical detail; for, strange to say, each figure was first carefully and completely fashioned in the nude, and the dress put on afterward. For the sculptors find that



A CONSULTATION.—O'DONOVAN IS SHOWN ON THE RIGHT, IN THE CENTRE IS EAKINS, AND ON THE LEFT, EAKINS'S PUPIL, MURRAY.

it is impossible to make boots and coat and trousers appear in the finished statue as if there was a body inside them, unless the body is there first.

Not less pains were taken in securing accuracy of dress than of face and figure. Grant is shown as a lieutenant-general,





O'DONOVAN POSING ON "BILLY" FOR EAKINS.

his grade being indicated by three buttons and a space, as seen in photographs of him taken at that time. The coat is buttoned in front, with perhaps a touch of idealization, for usually Grant left his coat carelessly open, it being his habit to pay little heed to dress. Lincoln is represented as he was just at the close of the war, shortly before his death. In his case the death-mask used by the sculptors was of especial service, since, unlike the one of General Grant, it showed none of the emaciation inevitable after a long illness. It is the one taken in Washington by Clark Mills, the sculptor, immediately after the assassination. Valuable suggestions, too, were obtained from a large photograph of Lincoln that is scarcely known to the public, but which Mr. O'Donovan regards as one of the most expressive in existence.

It has been said that Lincoln was a bad subject for the sculptor, because of his homely face and his lank, ungainly figure; but the fact is that there are few better. A sculptor worthy of the name takes as his highest work the depiction of character, and glories in his power to make dead clay and lifeless bronze shine with human attributes. To him the best of all subjects is a man of great soul, of a nature rich in those fine, large, human qualities that touch all men—pathos, tenderness, and poetic insight. Such a man preëminently was Abraham Lincoln; and a sense of the fact must have been strong in O'Donovan's

mind as he fixed in clay the deep-set eyes, the strong features, the tall, spare form, striving, with the cunning of his art, to infuse into the modelling Lincoln's strange, compelling personality.

In regard to the details of Lincoln's dress there was no difficulty, for an abundance of documents gave the sculptors ample data. He sits with head turned as if toward passing troops, holding in one hand a narrow-brimmed high hat—the very hat shown in the well-known photograph of Lincoln and Allan Pinkerton, with a wide mourning band, donned probably in token of the death of his boy Ted. He wears the familiar wide-skirted broadcloth coat, buttoned together down the front with many wrinkles. The waistcoat is opened low, showing an expanse of shirt front, and a queer turn-over collar with a small cravat.

Being done first in clay, the statues were afterward reproduced in plaster. The clay used by many sculptors of the day is not the ordinary variety, but a composite clay



EAKINS AT WORK IN THE FIELD WITH "BILLY" AS A MODEL.

prepared by a secret process, its special virtue being that it is in no danger of cracking, and removes the necessity of keeping it constantly sprinkled with water. The clay in one of these large statues is never a solid mass, but only a layer an inch in thickness or less, spread over a skeleton of lath braced with burlaps and iron rods. But even so the quantity of clay required is very considerable and expensive.

When the clay has been wrought under the sculptor's hands into the finished object of art, it is spread over with liquid plaster of Paris, one section at a time. Every portion of the clay figure having been thus reproduced in shells of plaster varying in thickness from one to two or three inches, these shells are united together and duly

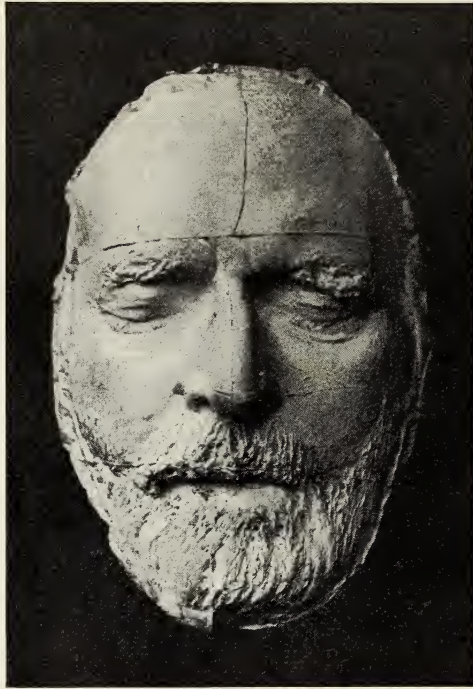
strengthened with braces, forming what is known as the plaster negative. It is a hollow mould of the statue with every detail reproduced on the inside, but reversed. Now, in order to get the plaster positive which will be sent to the bronze foundry, it is only necessary to pour into this negative mould more liquid plaster, first covering the inner surfaces with boiled soap, or a mixture of soap and oil, to prevent the plaster poured in from adhering to the hardened plaster. The mould is not filled with liquid plaster, but receives only such a quantity that, by tipping the negative back and forth in all directions, the fresh plaster will be distributed in a layer of the desired thickness over the whole interior. There is quite a knack in doing this; and also in mixing the plaster to just such consistency that when it sets it will show a high degree of hardness and give out a clear, metallic ring when struck.

When the inner layer of plaster has set, it is separated from the outer layer, or negative, by chipping off the latter, thus leaving exposed the plaster positive, which is a perfect reproduction of the clay model, except that it is appreciably larger; for, unlike bronze, plaster expands in changing from the liquid to the solid state, it being a curious fact that the two expansions which occur in forming the plaster negative and positive exactly counteract the single contraction experienced by the bronze in cooling. So it happens, very conveniently, that the sculptor in doing his work need be in no way influenced by the fact that bronze contracts one-eighth of an inch to the foot, but may make his clay model of exactly the size desired in the finished statue.

The statues of Grant and Lincoln having been thus completed in plaster, but in several parts for convenience in casting, these parts were conveyed with the greatest care to the bronze foundry. I doubt if New

York has any industry at once so full of interest, and so little understood, as this of the bronze moulders. To get on well here, one should know French, for most of the workmen come from France, to which country, with the exception of Japan, the world looks for the highest skill in this art. Some of them, before coming to New York, worked for years in the famous Fonderie Barbédienne in Paris. Very proud they are of their skill; and the foreman, whom everybody calls Dominick, although his name is Dominick Demeslay, smilingly showed me a first-prize medal awarded him as far back as 1869, at the Paris Exhibition, for fine work in bronze.

At the back of the building is the foundry proper, one long, high room, lighted from the sides by mud-splashed, iron-barred windows, while through the pointed roof, all of glass, and kept clean by the rain, come down floods of light. It is a place of heavy beams, and heavy brick walls hung with dusty art relics and the ponderous tools of the trade. In the summer it is cool with many draughts; in the winter the men are warmed by a big stove standing in front of a twelve-foot plaster cast of Washington, yellow with dust and shel-



DEATH-MASK OF GENERAL GRANT, MADE BY KARL GERHARDT.

lac, one of O'Donovan's pieces. There is a prevailing color of dull red from the sand used in moulding, many tons of which are heaped up in one corner, boarded off so as not to encroach too much upon the workmen's space.

Down the centre stretches a row of benches, over which bend red-faced workmen in blue overalls, whose appearance suggests medical students making anatomical studies in the dissecting room. One man is working at an arm, another at a leg, another at a bust, the dull white of the plaster being not unlike the ghastly corpse tint. In reality, these men are with deft hands transferring to the red



sand the forms of the plaster models.

The men work silently for the most part, scraping, scraping, with bended heads, taking away the sand little by little, almost grain by grain, to such an extent is this a labor of patience. That twelve-foot Washington took a whole year of one man's work before the mould had reached completion. Days will pass when the men do nothing but tamp down the sand around the plaster model, packing it in tightly with unceasing strokes, a little at a time, until it is right. I have watched three workmen standing for hours on a huge flask, as they call the iron frames that hold the moulds, pressing down the red sand with their feet, and driving it down with heavy iron tools broadened at the head for that purpose. They were doing this over a *bas-relief* nine feet long by six feet wide, and many tons of the sand had to be packed in in this way, a basin-full at a time.

The foundrymen say that no satisfactory article has ever yet been written, not even



JESSE GRANT POSING AT WEST POINT FOR THE FIGURE OF HIS FATHER.

forced to take refuge in generalities, singling out for special notice some of the more dramatic phases of the work. There is no lack of these. To give a brief outline of the process, one may say that the moulds of large statues are made in two parts, the

outer covering, made by packing the sand around the plaster model, and an inner core, also of hard-packed sand, which preserves the general shape of the plaster model, but is appreciably smaller, so that when placed inside the outer mould of sand there remains between the two parts a space varying from one-eighth to three-eighths of an inch. It is this space which is filled by the molten bronze, whose thickness is greater or less, according to the distance left between the core and the outer mould of sand. No core is used in *bas-reliefs*, the bronze being poured between two horizontal surfaces of sand, the upper one bearing a reproduction of the sculptor's work.

It is easy enough to indicate all this, but not so to do it. A thousand difficulties present themselves at every step of the execution. If the sand is too damp or too dry, it will not retain the impression of the



CAPTAIN CRAIG, CAVALRY INSTRUCTOR AT WEST POINT.

in the encyclopædias, on the moulding and casting of bronze statues. This is largely due to the intricacy of the processes, and the endless detail that must needs be understood and faithfully presented. One is

model; unless the core and the outer mould are braced in exactly the right way, the whole thing will go to pieces when the metal is poured in; unless air-vents are arranged in just the right places through the mould,

bubbles will form in the bronze and the casting will be spoiled; unless every part of the mould is baked to a sufficient degree of hardness in the oven, moisture will remain and rending gases be generated with the first touch of the liquid bronze; in short, unless a hundred things are done in exactly the right way, with neither too much nor too little, nor too long nor too short, the whole casting will be spoiled and months of labor go for naught. For seven months the workmen were busy with the Grant and Lincoln statues. The largest mould ever made in the

foundry was the one for the body of Grant's horse, which required a flask ten feet by five, and three and a half feet high; the entire weight, when the iron frames were clamped around the well-braced sand, being not less than twelve tons.

The last touch having been given to the mould, the sand being properly baked, the core being firmly braced, the inlets through the sand for the bronze being properly arranged, as well as the outlets for the air, and the whole surface of sand where the metal will touch it having been brushed over with black-lead to give a harder and smoother surface, the two parts of the massive iron frame that supports and encloses it all are clamped solidly together, and everything is ready for the pouring. But first the heavy flask must be lifted and set down nearer the furnaces. No easy task is this, for some of the flasks with their loads weigh as much as two elephants—say ten or twelve tons. And now one understands the purpose of the curious railroad arrangement overhead, with its double platform stretching across the whole width of the foundry, and resting on wheels that run on tracks supported by twin beams forty feet in

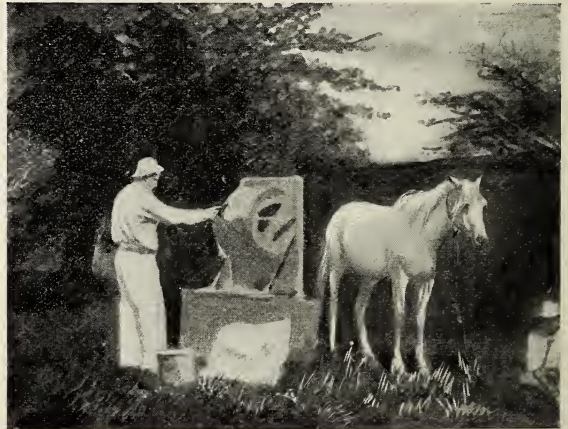
length. These beams are built into the walls of the foundry and rest upon heavy brick columns. A first glance at this queer aerial hand-car, as it seems, shows a confusion of wheels at either end geared together for a purpose that presently becomes

clear. It is merely to allow the workmen, without great effort, to move the ponderous crane with its heavy block and tackle, and its heavier load, to any point in the length or width of the foundry. This they do by pulling on endless chains that hang down from the wheels, and roll the great mass in any desired direction. Mean-

time, on the platform ten feet in the air, two men, with hands on the iron handles of the big windlass, raise and lower, as is needed, flasks of any weight up to fourteen tons; indeed, such is the enormous gain in power of the



EAKINS POSING ON "BILLY" FOR O'DONOVAN.



EAKINS AT WORK WITH "BILLY" FOR A MODEL.

pulley that a single man could manœuvre such a load, were it not that some accident or act of carelessness might result in his letting the handle slip, and the flask go crashing downward. Imagine the shock to an ordinary building should fourteen tons





MAKING A MOULD FOR THE BRONZE CASTING.

Interior of the National Fine Art Foundry in East Twenty-Fifth Street, New York. Most of the workmen are French.

fall to the floor from the height of a man's head. Once in his experience Dominick has known such an accident to happen, and he says the shock was like that of an earthquake. The same crane is used in handling the big plaster casts as they are received at the foundry, for even plaster is very heavy, especially while it is still damp from the hands of the worker. I saw a *bas-relief* of a battle scene one day that weighed nearly a ton.

The crane is also used in lifting various parts of the mould from the benches where they have been finished, and swinging them over to the iron truck which rolls them into the big oven, down at the end of the foundry by the furnaces, where the dampness is baked out of the sand in a long heating. This part of the preparation is most important, for should the molten bronze on being poured into a mould come in contact with any moisture, there would be such quick formation of steam and gases as would not only ruin the casting, but might cause an explosion. Therefore every part of the finished mould is left for hours in the oven to harden and grow dry, and under this process the sand becomes almost as hard as stone. It is usually at night

that this drying process goes on. The iron car, eight feet long, and more than half as wide, with its load of well-wrought sand, hard packed, but still damp, is rolled into the oven—a brick-lined room ten feet long, eight feet high, and six feet wide—and left there all night over two barrels of charcoal burning under a forced draught in the fire-pit at the bottom. Long before morning, the huge iron shutter that drops to the floor and closes the oven is red-hot, and to peep through a crack at the side and see the space within shimmering with gases, and luminous with heat, suggests some rough crematory. Still more weird is the fancy called up by the appearance of the adjoining brick walls which stretch away to the left as far as the furnaces, hung with iron rods bent into incomprehensible shapes, as if designed for use in some chamber of horrors. Really these queerly twisted rods are but the skeletons for the cores used in the moulds.

Four or five hours before a pouring, the men begin melting the copper in crucibles which are about the size of ordinary water-buckets and made of a preparation of plumbago that prevents the molten metal from adhering to the surfaces. Each

one of these crucibles weighs about forty pounds, and into each are thrown a hundred pounds or more of bright little bricks of pure copper. Loaded thus, the crucibles are carried by the men to the extreme end of the foundry, where six iron covers about eighteen inches in diameter mark the location of six furnaces built underneath the floor. Although the covers fit tight with a good weight of metal, one sees by the bright glow through the cracks that the fires are burning fiercely below. Into each of the six furnaces a single crucible is lowered, the furnace, when the iron cover is removed, throwing up withering heat and a dazzle of light into the workmen's faces. The crucibles are left on their beds of white-hot charcoal until, in their turn, they grow first red, then white, and the copper becomes like water within. Then, when the time is right, Dominick, skilled in the mysteries of blending metals, orders the covers pushed back, and with accurate hand lets fall into each crucible small chunks of tin and zinc, the exact quantity used being a precious secret

of the foundry, a part of its treasure, like the workmen's skill in moulding the sand. It is sufficient to know that the bronze alloy is ninety per cent. pure copper, the additions of tin and zinc varying with the individual preference of each founder.

No sooner do the bits of strange metal strike the molten copper than they melt away like pieces of snow thrown into boiling water. They only serve to slightly cool the fiery mass, which is now brought to even greater heat than at first by means of charcoal thrown into the crucibles, where it floats and burns white-hot like the rest upon the swimming bronze. To test the heat the workmen thrust in iron tools from time to time, long pokers they look like, and if any particle of the metal in the crucible sticks to the end when these are drawn out, it is seen that the bronze is still too thick, and must be given greater heat. When the pokers

come out as clean as they went in, the men know that the bronze is ready for pouring.

Now all is ready—the metal, the mould, and the men, who stand about in strange dress waiting the word from Dominick. They are about to heave at a great load while scorched with such heat as few men could endure. Long pieces of carpet shield their bodies in front like thick aprons, while their arms, and hands, and even their shoes are wrapped in folds of canvas. Already their necks and faces show red with black streaks over their jerseys, and under the wide-brimmed felt hats, whose brims pull down as shields almost to their chin. Now, as a last precaution, each one dashes himself or his fellow with water; and then with a quick glance about him, Dominick, directing every-

thing from a little distance, calls out, "Ready." Sometimes he says it in English, sometimes in French, for among the lifters there are Americans as well as Frenchmen.

Back goes the first cover, and braving the heat, Patrick Molloy thrusts down the huge iron tongs with nippers on the



POURING THE MOLTEN BRONZE INTO THE MOULD.

ends, big enough to encircle the crucible. Six feet long they are, these tongs, their two handles being joined midway by a heavy chain with an iron ring in the middle. To this ring John Power fastens an iron hook that hangs from the block and tackle above, and then hauls away, while Molloy clasps the crucible with the tongs and guides its course.

"Montez," calls out Dominick, "assez, ça y est."

The white-hot crucible, heavy with its load of fire, hangs a moment in mid-air, and is swung around and lowered into the shank, a heavy implement consisting of a circle of iron just large enough to receive and hold the tapering crucible, with double iron handles at either end three feet in length, so as to keep the men who lift as far as may be from the frightful heat. The shank is manned now by Constant Graffin and John Vion, whose muscles stand out as they move



with their three-hundred-pound load, for the shank weighs forty pounds, and the bronze in the crucible at least two hundred pounds. Resting the glowing crucible on the ground, they tip it sideways, while Molloy, using another iron tool, skims off from the surface of the molten bronze the charcoal and impurities. Let them hold steady now, for it would go hard with some one should a careless movement spill that bucketful of bronze, as befell once, in 1890, when one of these very men, John Vion, had seventy pounds of molten brass poured over his right foot, caught in a treacherous grating—poured slowly for full two minutes before his comrades could rescue him; and sickening scars tell how cruel the metal was.

Like quicksilver the bronze shines now, cleaned of its dross, and the shank-bearers carry it to the nearest mould and stand ready to pour.

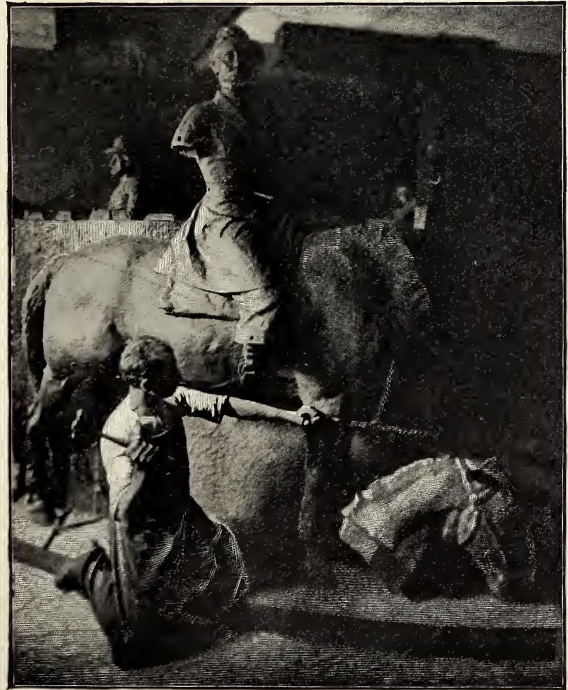
"All right," cries Dominick; and from the mouth of the crucible a heavy stream of bronze—it looks like a rope of fire—goes spitting into the openings in the sand. On the surface of the metal burn greenish flames; and from above the crucible, grown scarlet, rise grayish fumes, that spread through the foundry and take one in the throat. Four men work in the pouring—two at the shank, one hauling back the crucible from beneath with an iron implement and helping in the tipping, and the fourth keeping back from the outlet any impurities that may still remain. Dominick leans over, eyes intent on the glowing stream, ready to give the word. Five men in a circle of fire, suffering but enduring, sweat starting from every pore, faces red and black, heads turned sideways to save their eyes as much as may be—here, indeed, is a study in color!

"Hold up," calls out Dominick, "assez." And the men, nothing loath, withdraw. If there is bronze still in the crucible, they pass on to the next mould and pour it there; if not, they leave the empty crucible and return to the furnaces for another. In turn, all six are lifted and emptied, the men working quickly, as may be believed. Ten minutes suffice for even a large pouring, say a ton of bronze, for as much as that is sometimes required in statues of great size. In O'Donovan's twelve-foot Washington, not less than twenty-five hundred pounds of bronze were used.

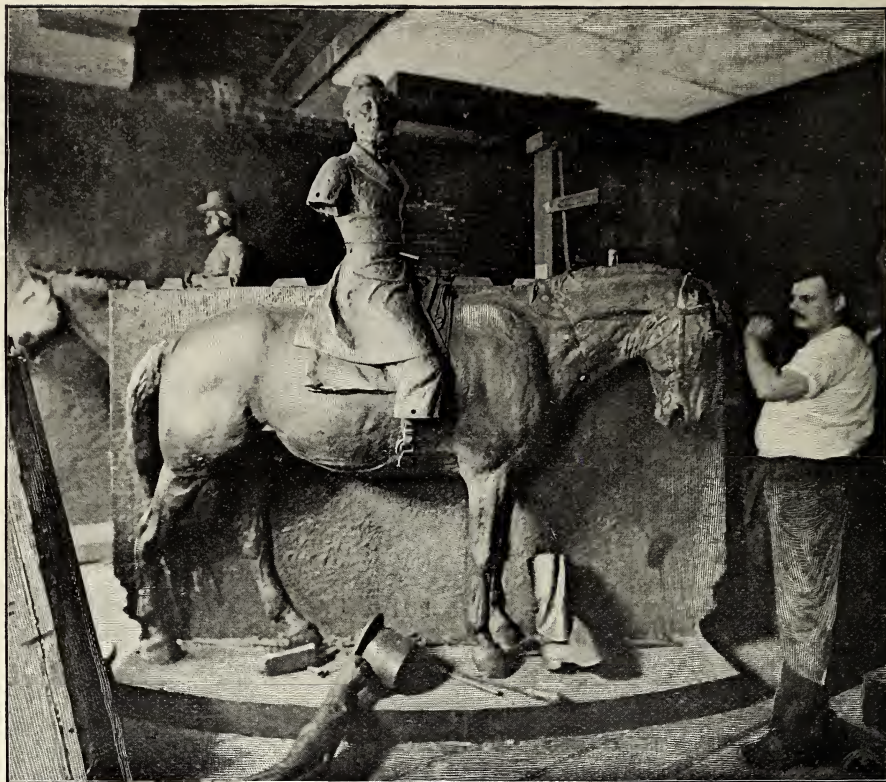
In each pouring I noticed that a white powder formed on the surface of the liquid bronze, this being due, of course, to its contact with the air. The workmen call this powder *calamine de cuivre*, and they attribute to it precious properties for curing affections of the eyes, and sometimes collect small quantities for friends or members of their families.

After a pouring, the bronze is left in the moulds until it has cooled sufficiently to allow them to be opened, the time required for this varying according to the size of the pieces. Small moulds may be safely taken apart within half an hour; while large ones, like those of the Lincoln and Grant statues, must be left untouched over night. Very curious is the appearance of a bronze casting immediately after the mould has been opened. Its surface is variegated with many colors, delicate tints of rose and silver-gray, deep purples, and blendings of green and yellow. This unexpected coloring is due to the rapid oxidation of the surface bronze while cooling. Could an artist preserve these colors and control their arrangement, some beautiful effects might be obtained.

What is done with the bronze pieces after taking them from the moulds, and chipping



SETTING UP THE BRONZE CASTING OF THE LINCOLN STATUE AND RIVETING THE SECTIONS TOGETHER.



SETTING UP THE BRONZE CASTING OF THE LINCOLN STATUE AND RIVETING THE SECTIONS TOGETHER. A SECOND VIEW.

away the bits of metal that filled the inlets and now adhere like tentacles, is to place them in "pickle" over night in a bath composed of vitriol and water. The bronze comes out of this the next morning clean and bright, and shining like gold. Then it is brought upstairs to the finishing department, where the seams are chiselled off and the matting process is gone through with; the mats being spikes of the best stub steel, which are struck against the bronze wherever any roughness shows, to bring back each perfect detail of the sculptor's modelling.

Next, the various portions of the casting are put together, there being as many as six or seven sections in large statues like the ones in question. In fastening the rivets, no particle of iron or steel is used, but only the best of bronze, so that every portion of the finished work shall offer equal resistance to the disintegrating influence of the atmosphere; and, as a further precaution against this danger, the finished statue is subjected to a process of "bronzing," as it is called, or oxidizing, which gives to the surface a uniform color, setting the

tone that is to be preserved through centuries. Each founder has his own secret of "bronzing," the process consisting usually of applications of sulphur and acids until the desired coloring has been obtained. Then, to hold this fast and keep it from the air, the surface is spread over with a solution of beeswax, so thin as to be quite invisible, but sufficient for the purpose. It is claimed that if this process of bronzing is repeated every few years, statues may be preserved for an indefinite time without suffering any impairment in the beauty of their coloring or the surface finish. Each year will see them take on a deeper, richer coloring—that fine dark brown with golden glints in it that reminds one of the mellow coloring of a meerschaum pipe. Unless such precautions are taken, statues exposed to the air in all seasons will suffer sad changes in the lapse of time, turning black in places, while in other parts they will show an unpleasant mottling, taking on tints of green or reddish brown or soiled yellow, according to the quality of the air to which they are exposed.